City of Philadelphia
LED Street Light Pilot Project

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Outline

Overview and Background

Exploring energy efficient technologies

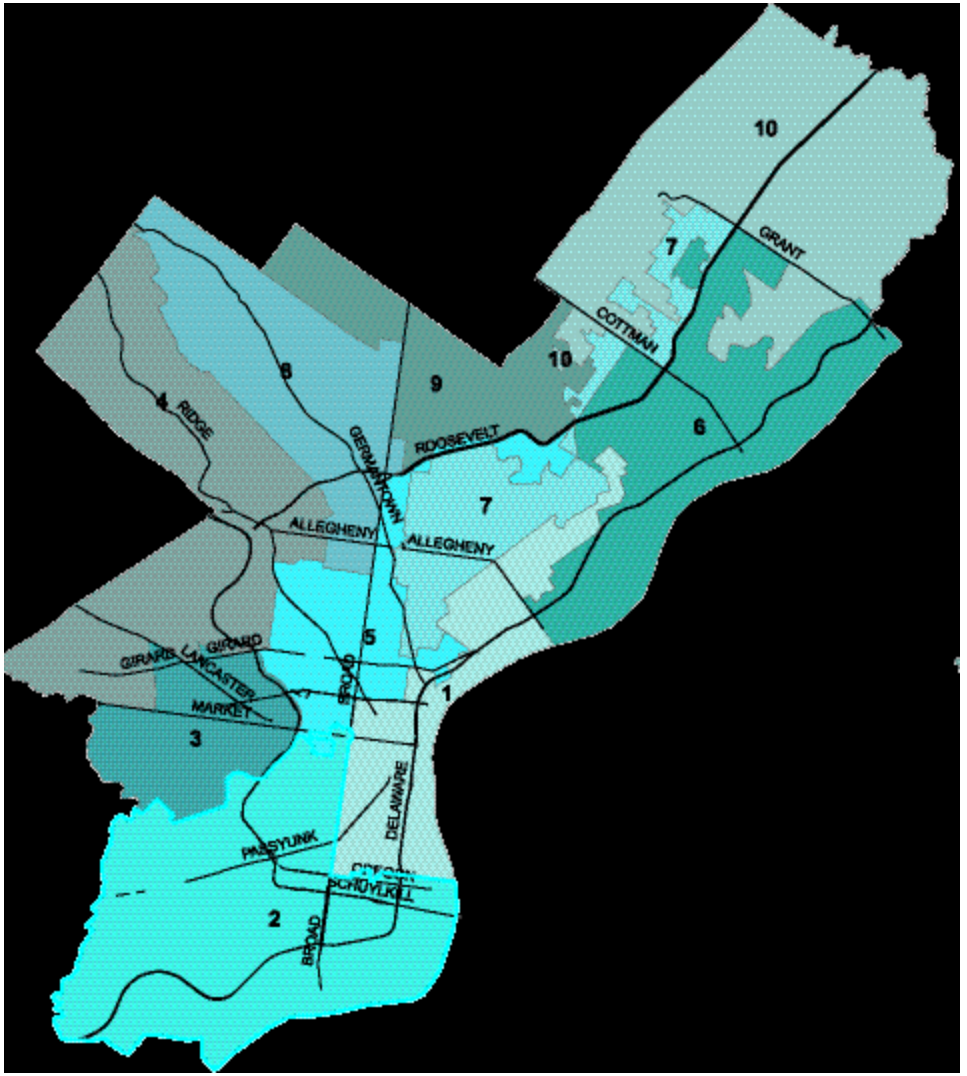
Key Considerations for LED Street Light

Financial Analysis

LED Pilot

Philadelphia

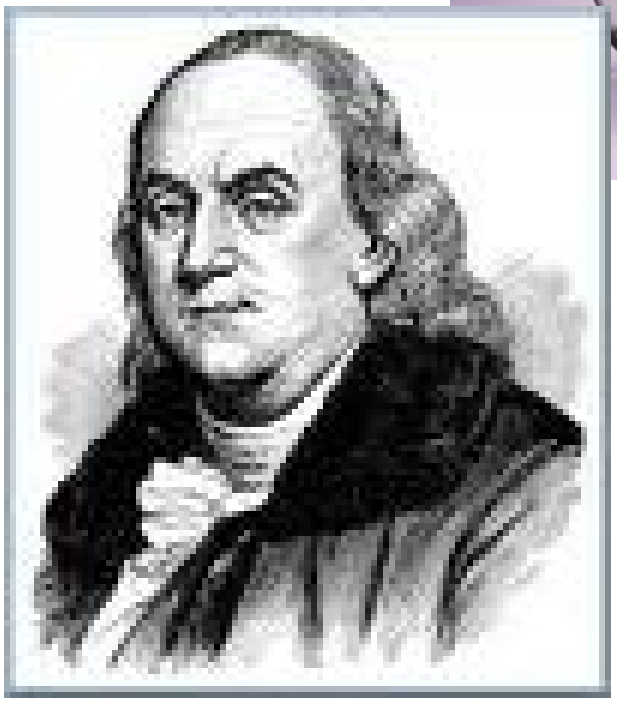
- 1.5 million people
- 143 square miles
- 100,000 street lights
- 4,000 ornamental light
- 18,000 alley lights



Philadelphia

- Street lighting first introduced in the US by Benjamin Franklin in 1771

- Philadelphia as “the birthplace of street lighting in the U.S.”



Greenest City in America

Released May 2009

- 5 Goals
- 15 Targets
- Over 150 Initiatives

"*Greenworks Philadelphia* [is] an exciting and ambitious plan to transform Philadelphia into the greenest city in the United States of America."

- Mayor Michael Nutter

Charge to City Departments

- City government to reduce energy consumption by 30% in 4 years

- Reduce City-wide energy consumption by 10% by 2015

GREENWORKS
PHILADELPHIA

GREENWORKS
GOALS, TARGETS, INITIATIVES

energy

PHILADELPHIA REDUCES ITS VULNERABILITY TO RISING ENERGY PRICES

- Lower City Government Energy Consumption by 30%
  - ✓ *85,000 Incandescent Traffic Signals replaced with LED's*
- Reduce Citywide Building Energy Consumption by 10%
  - ✓ *Cool Roof Legislation for all New Construction Passed April 2010*
- Retrofit 15% of Housing Stock with Insulation, Air Sealing and Cool Roofs
  - ✓ *Energyworks launched fall 2010*
- Purchase and Generate 20% of Electricity Used in Philadelphia from Alternative Sources
  - ✓ *2.3 Megawatts of solar generation to be installed in 2011*

Streets Department Power

2,926 signalized intersections (80,000 lamps)

100,000 street lights

- High-pressure sodium (HPS)
- 80,000 PECO power pole bracket-mounted
- 20,000 stand alone poles

4,000 ornamental lights

18,000 alley lights

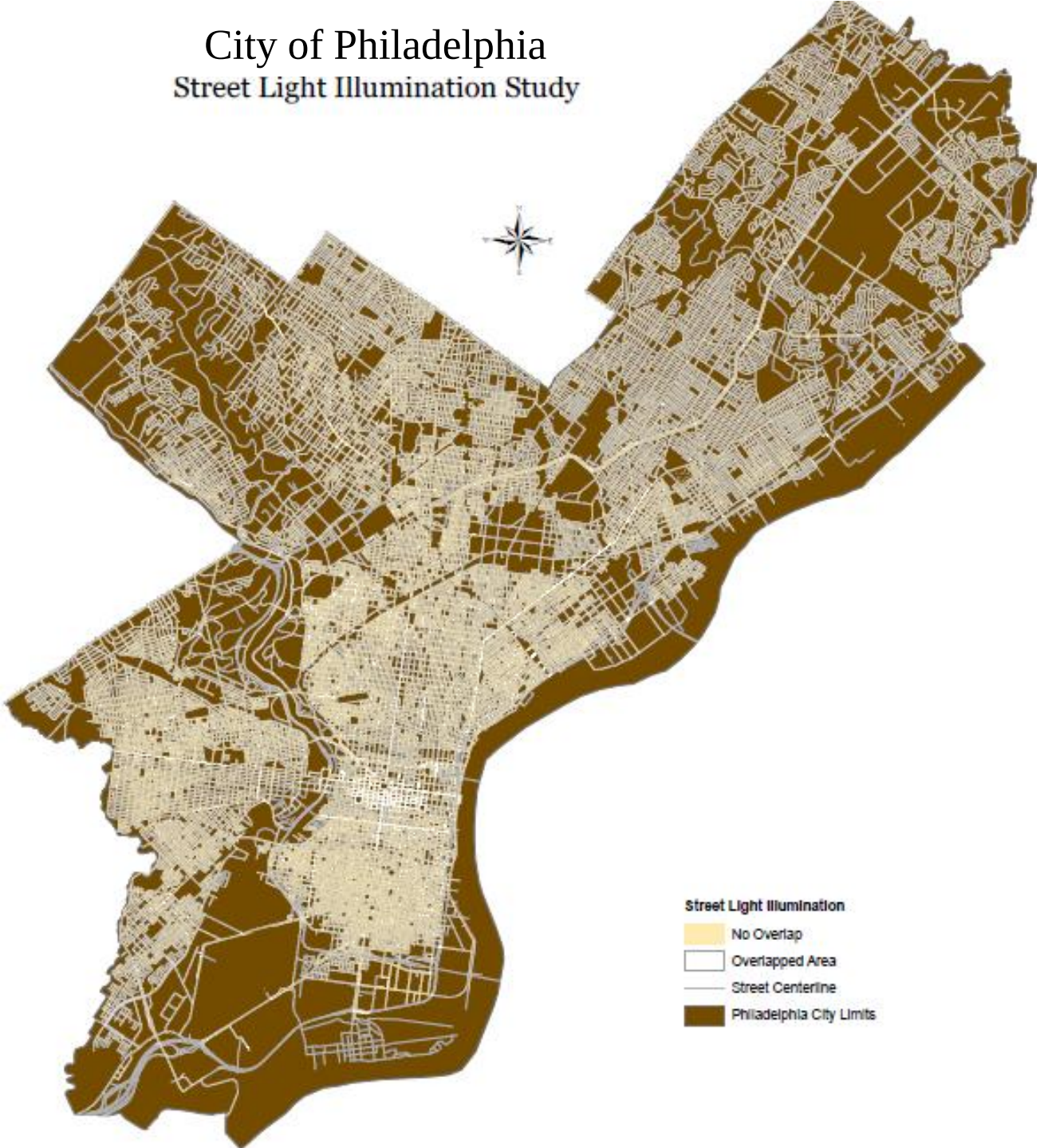
- High-pressure sodium (HPS)
- All stand along poles

Traffic Signals and Street Lights:

- Currently 79,000 MWh per year
- 58% of the City's General Fund energy consumption

City of Philadelphia

Street Light Illumination Study



Financial Analysis

Account for:

- Capital Cost (including incentives)
- Energy Cost
- O&M Cost
- Financing

Key variables:

- Capital Cost
- Power Price Structure and Rate
- Useful Life of Product

Financial Analysis

Retrofit Assumptions	
Total Installation Out-of-Pocket Spending	$0
Loan Borrowing	$37,028,808
Loan Interest Rate	5.0%
Loan Term (Years)	8
Installation Type	Group
Phase-in Period -- Group Only (Years)	5
Annual Change in Energy Price	1%
Annual Change in Service Location Charge	1%
Annual HPS Non-burnout Failure Rate	0.1%
Annual LED Catastophic (non-fadeout) Failure Rate	1.0%
Year of Payback	15
Common Data	
Annual Fixed Maintenance Cost	$0
Hourly Labor Cost	$21.567
Hourly Vehicle Cost	$25
Baseline HPS Data	
Bulb Life (Burn Hours)	24,000
Ballast and Luminaire Life (Calendar Hours)	200,000
Photocell Life (Calendar Hours)	80,000
Bulb Installation Time (Minutes)	30
Ballast and Luminaire Installation Time (Minutes)	45
Photocell Installation Time (Minutes)	30
Bulb Cost	$12
Ballast + Luminaire Cost	$100
Photocell Cost	$10
Retrofit LED Data	
Bulb/Photocell Life (Burn Hours)	65,000
Luminaire Life (Calendar Hours)	200,000
Initial Installation Time (Minutes)	30
Availability of Rebates	Yes
38kWh - 90kWh LED Rebate	$65
110kWh - 210kWh LED Rebate	$120
LED Annual Price Reduction (first 10 years only)	5%
Subsequent Bulb/Photocell Replacement Time (Minutes)	30
Subsequent Luminaire Replacement Time (Minutes)	30

LED lamp price data needs to be entered on the "Retrofit Lamp Data"

All formulas are protected. Password to unprotect: Philadelphia

		Actual Tariff		Multiplier		For calculations	
Energy Cost	$	0.0594	per kWh	100%	$	0.0594	per kWh
Use-based Distribution Charge	$	0.0050	per kWh				
Use-based Transmission Charge	$	-	per kWh				
T & D total	$	0.0050	per kWh	100%	$	0.0050	per kWh
Capacity Transmission/Distribution Charge	$	-	per Watt	100%	$	-	per Watt
Service Location ("Tap") Fee	$	7.11	per location per month				
Energy Efficiency Program Charge	$	0.63	per location per month				
Total	$	7.74	per location per month	100%	$	92.88	Annual total per lo
State Tax Adjustment Credit		0.06%	Off of T&D and Tap Fees				

30-Year Totals	Baseline	Retrofit	Difference
Total Cost of Initial Installation	$0	$37,028,808	$37,028,808
Total Financing Cost of Initial Installation	$0	$8,804,507	$8,804,507
Total Energy Payments	$145,034,455	$73,643,416	($71,391,039)
Total Service Location Payments	$312,914,680	$312,914,680	$0
Total Maintenance Charges	$46,469,880	$35,205,172	($11,264,709)
Total Expenditures (including tap	**$504,419,015**	**$467,596,582**	**($36,822,434)**
Total Energy Usage (kWh)	**1,941,996,709**	**994,798,152**	**(947,198,557)**
Total GHG Emissions (MT CO2ec	**1,073,116**	**549,709**	**(523,407)**

Annual Costs for Instant Change (Excluding Installation Costs)	Baseline	Retrofit	
Total Energy Cost	$3,845,801	$1,836,048	
Total T&D Cost	$323,666	$154,524	
Total Service Location Payments	$8,995,707	$8,995,707	
Total PECO Bill	$13,159,582	$10,979,860	
Annual Maintenance	$1,548,996	$1,173,506	(total averaged over 30 years)
Overall Allocated Cost	**$14,708,578**	**$12,153,366**	**($2,555,212)**
Initial installation cost		$37,028,808	
GHG Emissions (MT CO2eq.)	35,771	17,077	
Internal Rate of Return	9%		
Return on Investment	80%		

Financial Analysis

Calender Hours Luminaire	Bulb Burn Hours	Rebate	Loan Amount	Interest Rate	Loan Term	Change in Energy Price	HPS Non-Burnout Failure Rate	LED Catastrophic Failure Rate	Phase-in	LED Price Reduction	Year of Payback	**Return on Investment**
200,000	65,000	Yes	$37,028,808	5%	8 Years	1.0%	0.1%	1.0%	5	5%	15 Years	**$36,822,434**
200,000	65,000	Yes	$37,028,808	10%	8 Years	1.0%	0.1%	1.0%	5	5%	21 Years	**$27,129,120**
200,000	65,000	Yes	$37,028,808	15%	8 Years	1.0%	0.1%	1.0%	5	5%	25 Years	**$16,640,763**
200,000	65,000	Yes	$37,028,808	3%	8 Years	1.0%	0.1%	1.0%	5	5%	14 Years	**$40,455,826**
200,000	65,000	Yes	$37,028,808	N/A	N/A	1.0%	0.1%	1.0%	5	5%	13 Years	**$45,626,940**
200,000	65,000	Yes	$37,028,808	5%	15 Years	1.0%	0.1%	1.0%	5	5%	14 Years	**$29,144,147**
200,000	65,000	Yes	$37,028,808	10%	15 Years	1.0%	0.1%	1.0%	5	5%	28 Years	**$9,630,990**
200,000	65,000	Yes	$37,028,808	3%	15 Years	1.0%	0.1%	1.0%	5	5%	1 Year	**$36,129,099**
200,000	65,000	Yes	$37,028,808	5%	8 Years	2.0%	0.1%	1.0%	5	5%	15 Years	**$49,379,157**
200,000	65,000	Yes	$37,028,808	5%	8 Years	3.0%	0.1%	1.0%	5	5%	14 Years	**$64,602,732**
200,000	65,000	Yes	$37,028,808	5%	8 Years	0.5%	0.1%	1.0%	5	5%	16 Years	**$31,386,527**
200,000	65,000	Yes	$37,028,808	5%	8 Years	0.0%	0.1%	1.0%	5	5%	17 Years	**$26,440,454**
200,000	65,000	Yes	$37,028,808	5%	8 Years	1.0%	0.1%	0.5%	5	5%	15 Years	**$40,777,208**
200,000	65,000	Yes	$37,028,808	5%	8 Years	1.0%	0.1%	0.1%	5	5%	14 Years	**$43,941,028**

Key Elements to Decision-making

- Pricing Structure
  - Philadelphia's tap fee
  - Power rate
- Age of your infrastructure
  - Sunk costs
- O&M Costs
  - Life expectancy of lamps
  - Inspection service

Just because the financials don't align, it doesn't mean that you shouldn't do it

Key Findings

Factors

- Capital costs
- Useful life of products
- Power pricing structure
- Cost of energy
- Financing

LED Street Light Pilot

- Partners
  - MSSLC
  - Pacific Northwest National Laboratory

- Goals of the Pilot
  - Test latest products
  - Advance state of the practice
  - Test public opinion and preferences in Philadelphia

- Site selection
  - Developed in conjunction with MSSLC
  - Geographic distribution
  - Varied environments

- Product Selection

LED Pilot Locations

Memorandum of Agreement

- All donations of lighting equipment (Donations) must be commercially available products that are ready for purchase, and, therefore, may not be products that are only in the experimental or beta stage.
- All Donations will become property of the City of Philadelphia and will not be returned to the LED Provider
- The City reserves the right to turn down any Donations that in the City’s sole judgment do not fit the City’s needs or standards.
- The City reserves the right to remove the Donations if they are no longer meeting the City's lighting standards.

City Responsibilities

- The City shall be responsible for installation, and shall install the Donations subject to the manufacturer's standards.
- The City may monitor the performance of the Donations and may evaluate them for potential City purchase and use.
- The City shall review all media materials and advertising highlighting the Donations and their use by the City submitted by the LED Provider and if acceptable, approve them in a timely manner.

LED Pilot Locations

Check List

- Require that L_{70} data was produced per testing that meets LM-80-08 standards
- Require the LM-79-08 report from an independent test lab, with the LED array tested inside the fixture
- Carefully consider the fixture manufacturer's approach to thermal management
- Confirm the Color Corrected Temperature that any data is based on.
- Specify or verify the Light Loss Factor used on photometric comparison/layout
- Light Distribution

LED Pilot Locations

Check List

- How many years is the LED array warranty? What triggers it? What does the warranty entail?
- Does the driver have the same warranty as the LED array?
- Who is backing up the warranty?
- Do we need to rewire the LED?
- Weight? Size? Appearance?
- Installation check list.

LED Pilot Locations

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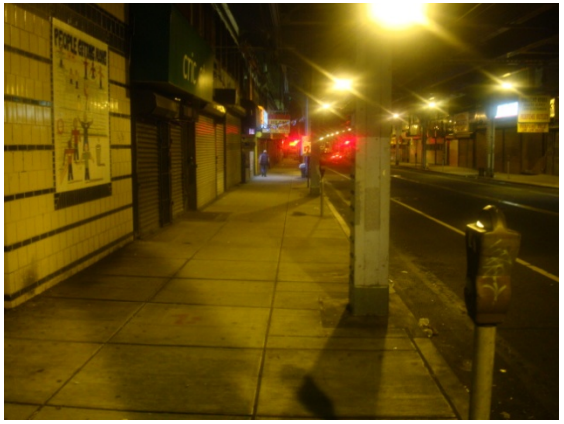

LED Pilot Locations

Questions

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